

Claims

1) A cavity ring-down spectrometer comprising:

- i) a resonant optical cavity comprising at least two high reflectivity mirrors;
- ii) a source for providing a continuous wave optical signal into said optical cavity, said source comprising an electrically pumped semiconductor gain medium;
- iii) a first detector for monitoring the intensity of radiation emitted from said cavity and generating a first detection signal based thereon;
- iv) a first controller for deactivating said optical signal based on a comparison of said first detection signal and a predetermined threshold and for thereafter reactivating said optical signal after a delay period in excess of the ring-down time for said optical cavity;
- v) a second detector for monitoring the wavelength of the reactivated optical signal and generating a second detection signal based thereon;
- vi) a second controller coupled to said second detector which second controller adjusts both the temperature of, and the current to, said gain medium to thereby achieve a desired emission wavelength;
- vii) means for adjusting the beam path length of the optical cavity to be in resonance with said desired emission wavelength.

2) A cavity ring-down spectrometer in accordance with Claim 1 wherein said optical signal source comprises at least one distributed feedback diode laser.

3) A cavity ring-down spectrometer in accordance with Claim 1 wherein said optical signal source comprises an array of lasers.

4) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first detector comprises a photodiode or avalanche photodiode.

5) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first controller includes means for deactivating said optical signal by terminating the current flow to said semiconductor gain medium.

6) A cavity ring-down spectrometer in accordance with Claim 5 wherein said current flow is terminated by shunting the current to an alternative medium.

7) A cavity ring-down spectrometer in accordance with Claim 1 wherein said first controller includes means for shifting the frequency of said optical signal to a value out of the resonance range of the optical cavity.

- 8) A cavity ring-down spectrometer in accordance with Claim 1 wherein said second detector comprises an etalon, a beam splitter and a pair of photodiodes.
- 9) A cavity ring-down spectrometer in accordance with Claim 6 wherein said resonant optical cavity comprises three or four mirrors.
- 10) A cavity ring-down spectrometer wherein said second controller includes means for substantially continuously monitoring the temperature of the gain medium, and look-up tables indicating the temperature and current required to cause a desired laser emission wavelength.
- 11) A cavity ring-down spectrometer wherein said means for adjusting the beam path length of the optical cavity comprises a piezo-electric transducer capable of translating one of the cavity mirrors.
- 12) A method for detecting the presence of an analyte in a resonant optical cavity comprising at least two high reflectivity mirrors, said method comprising the steps of:
- i) directing a continuous wave optical signal from an electrically pumped semiconductor gain medium into said optical cavity;
 - ii) detecting radiation emitted from said optical cavity through one of said mirrors and comparing the intensity of said emitted radiation with a predetermined threshold value;
 - iii) based on said comparison, generating a control signal which deactivates said optical signal for a period which is at least in excess of the ring-down time for said optical cavity;
 - iv) reactivating said optical signal and again directing said signal into said optical cavity
 - v) monitoring the wavelength of said signal;
 - vi) adjusting the temperature of, and current to, the source of said optical signal to thereby cause it to emit a signal having a desired wavelength;
 - vii) adjusting the beam path length of said optical cavity by translating at least one of said mirrors to thereby bring said cavity into resonance with said desired wavelength optical signal.
- 13) A method in accordance with Claim 12 wherein said optical signal is deactivated for a period of at least about five ring-down times.
- 14) A method in accordance with Claim 12 wherein said optical signal is deactivated by interrupting the current flow to said gain medium.